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# GENERAL SUGGESTIONS FOR MARKING PAPERS IN THE STATE EXAMINATIONS, BASED UPON A PASSING MARK OF SIXTY PER CENT.

By A. Latham Baker, Charles E. Bikle, Grace A. Bruce,
Lao G. Simons, and Eugene R. Smith.
*A Committee of the New York Section.*

These figures are intended as general suggestions for the class of errors designated, an indication of the views of a number of markers of examination papers, to be modified by each marker according to the particular features of each answer paper.

Besides securing a greater degree of harmony among different markers, it is hoped to standardize the work of the individual marker, and harmonize the marking of one hour with that of the next.

The figures are based upon a total of 10 for the question; —4 indicating a deduction of 4; —4 +, of 4 or more; + 5 an allowance of 5, and so on. P.R.8 means apportioned on a basis of 8 for the question instead of 10.

The exponent attached to the rating indicates the number who have approved of that rating. Each reader can, if desired, strike an average for himself. It was thought that the components would be more instructive than the bare average.

These results have been submitted to the examination division at Albany and have received their general approval. Their divergence from the views expressed here is indicated in heavy type.

"With these slight exceptions [noted in heavy type] I would be willing to adopt your scheme as ours."

(Signed) Charles F. Wheelock,
*Chief of Examination Division.*

It is requested that every one interested send to the chairman of the committee, any additions, emendations, corrections or suggestions that may occur, with a view to a future report which can be based upon a very much larger number of suggestions. In fact let each person interested consider himself a member of the committee and send in his suggestions, both of approval of the present figures, to increase their weight, or of suggested changes.

The committee makes no specific recommendations but lets the collected material make its own recommendations.

## INTERPRETATION OF TERMS.

1. Show how to = (in construction problems in geometry) give correct diagram with enough explanation (where needed) to show what is intended.

2. Show how to = (in algebra) give a reasonably clear outline of the method to be used, or numerical illustration; any reasonably clear explanation which will show that the student has a fairly clear idea of what to do.

3. Find = (in construction problems) same as 1.

4. Find = (in computation problems) get an answer with enough intervening work to show that the student has really worked for an answer.

5. Find = (in algebra) find at least *one* value of the unknown [5]: find all the answers that will fulfil the conditions [3].

6. Find a = find *one* (*e. g.*, mean proportional).

7. Simplify = condense to compact form with exponents united, integers in numerators and denominators; additions and subtractions completed. (No negative exponent in the answer.)

8. Simplify = (in radicals) bring out from under the radical sign all that will come out, and leaving thereunder no fraction, or fractional or negative exponent, the radical of the lowest order.

9. Explain = any reasonably clear explanation; complete logical sequence not demanded.

10. Solve = find all the values of the unknown.

11. Prove = (theorem in geometry) give a formal demonstration.

12. Prove = (fact in geometry, not one of regularly recognized theorems of the text-books) give a reasonably correct sequence of conclusions or equations leading to the result sought, but not necessarily a completely formal demonstration.

13. Prove = (equation in algebra) any correct sequence of equations which produces the given equation from a recognized one, or reduces the given equation to a recognizable one by a

series of reversable operations: formality in the deduction of consequences not demanded.

14. Interpret = any reasonably correct explanation which shows that the candidate has a fairly correct idea of the subject.

15. Define = same as interpret; critical exactitude in minutiæ or use of terms not demanded; but definition must be correct within a fairly broad use of terms conf. (III, B, 3, 4, III, C, 7, 8).

## I. Mistakes in General Method. $-5$

### A. *General.*

1. General method correct, but vitiated by sporadic errors of logic. $-4^2, -5^4, -6^3$
2. General method correct, but vitiated by errors of inconsequence, inconclusiveness, irrelevancy. $-2^2, -3^2, -4^4$
3. Misinterpretation of question, possible justification, though improbable. $-3, -4^7$
4. Misinterpretation of question, no justification. $-5^2, -10^6$

### B. *Algebraic.*

1. Answer correct, but no intervening work, mental solution possible. $-0^4, -2^2, -4^2, -10$
2. Answer correct, but no intervening work, mental solution impossible. $-8^2, -10^6, -10$
3. Answer correct, but no intervening work, probable trial solution (*e. g.*, arithmetical mean). $-4, -5^4, -6^2, -10, -10$
4. Numerical example substituted for general proof. $-6, -7, -8^5, -10, -5$
5. Particular for general case. $-5, -6, -7, -8^4, -10, -5$
6. Arithmetical evolution of radicals instead of combination by similar radicals. $-4^4, -5^4$
7. Fundamental blunders, *e. g.*, $2y/y \doteq y$. $-2^3, -6^2, -7, -10$
8. Fundamental blunders, $(x-a)/(x-a)=0$. $-3^3, -6^2, -7, -10$
9. Fundamental blunders, unknown in the answer. $-6^2, -7, -10^5$
10. Failure to recognize mathematical absurdity of erroneous answer. $-5^8$

11. Wrong formula, subsequent algebraic work correct. $-5^6, -6, -7$
12. Distribution of exponents over terms, *e. g.*, $\sqrt{a^2-b^2}=a-b$; $(a+b)^2=a^2+b^2$. $-7^2, -10^6$
13. Operating upon an algebraic expression as if it were an equation. $-5^2, -6, (-3 \text{ to } 10)^2$

### C. *Geometry.*

1. Missing link in chain of proof. $-2+^2, -3, -4, -5^3, -5+$
2. Correct proof of allied theorem, so closely allied as to dubitate intentional substitution. $-3^2, -4, -5^4, -5+$
3. Using later theorem as authority when such order is possible though very improbable. $-0^8, -0$
4. Using later theorem as authority when the candidate's ability to use such order is very doubtful. $-0^2, -2^2, -3, -4, -0$
5. Using later theorem as authority when such order is impossible. $-5, -6^2, -10^5$
6. Using special figure for general (suggestive of wrong or incomplete conception) thus altering the hypothesis. $-5^6, -5+^2$
7. Giving special diagram, though not using its special features in the argument (suggestive of hazy conception). $-0^5, -2^8$
8. Proving part of hypothesis in addition to otherwise correct proof of the conclusion. $-2^2, -3, -4^3, -5^2, -0$
9. Incorrect diagram but bulk of demonstration correct (suggestive of memory work). $-5^6, -6^2$
10. Proof of converse theorem substituted. $-5^6, -10^2, -5$
11. Diagram unintelligible so that the text cannot be connected. $-3, -5, -10^6$
12. Imposing too many conditions on construction-lines, proof vitiated. $-6^2$
13. Imposing too many conditions on construction lines, proof not vitiated (conditions merely redundant). $-2^8, -3^4$

14. Assuming consequences from the looks of the diagram. $-3, -5, -8, -10^4$
15. Asserting a previous consequence which has not been drawn. $-2, -3, -5^5, -5+$
16. Special instead of general case in a construction problem. $-5^3, -8, -10^3, -5+$

## II. Secondary Mistakes, Especially where the General Method is Correct, Including Mistakes in Copying, Form, Use of Symbols, etc.

$-1$ to $-3$

### A. *General.*

1. Question wrongly copied, correctly carried out, work not easier. $-2, -3^6, -4$
2. Failure to omit mathematically impossible solution (*e. g.*, extraneous roots). $-1, -2^6, -3$
3. General method correct, but vitiated by errors of transcription. $-2^5, -3^3$
4. Pairing wrong values in final statement of answer. $-2^2$
5. Signs of inequality reversed (*e. g.*, $>$ for $<$). $-5^2$

### B. *Algebra.*

1. Method correct, but vitiated by initial error, easing the work somewhat. $-5^6, -6, -5+$
2. Method correct, but vitiated by initial error, not easing the work. $-2^2, -3^5, -5$
3. Interchange of requirements, solving for wrong element, algebra correct. $-3^7, -5$
4. Correct answer, vitiated by final blunder. $-2^2, -3^2, -3+$
5. Clerical error in transcribing from one line to another. $-1^3, -2^5$
6. Misuse of equality sign (*e. g.*, between corresponding expressions). $-1^3, -2^5$

### C. *Geometry.*

1. Correct step but wrong authority quoted. $-1^2, -5^2, -2+$
2. Incorrect reference to diagram (*e. g.*, to "line *AB*" when the part evidently meant is not so lettered). $-1^7, -2$.
3. Giving special diagram for general (suggestive of wrong conception) though not using the special features. $-0^5, -2^3$

4. Citation of authority by number (meaningless, or guess-work, or bluff). $-0, -1, -2$
5. Analysis into hypothesis and conclusion incorrect, the following work correct (suggestive of memory work). $-3^2, -3+, -4^3, -5^2$
6. Auxiliary line wrongly made, with following text correct for correct diagram (suggestive of memory work). $-2^3, -3^5$
7. Citation of some original problem as authority. $-0^2, -0+, -1^3, -2$
8. Construction problem data misread, correctly carried out, no easier. $-2, -3^5, -4, -5$
9. Construction problem diagram incorrect (*e. g.*, chord drawn across the given arc instead of to the ends) but statement and proof correct for a correct diagram. $-2^3, -3^5$

## III. MISTAKES IN AMOUNT OF WORK; WORK INCOMPLETE, OR CONTAINING TOO MUCH; WORK COMPLETE, BUT SOME OF THE STEPS OF LIKE VALUE INCORRECT.

Deduction to be made in proportion to amount omitted, minor omissions or insertions. $-1$ to $-3$

### A. *General.*

1. Work correct as far as carried, not finished. P.R.$8^2$, $-2+$, P.R.$^3$
2. Work complete, some co-ordinate independent steps wrong. P.R.$^6$, P.R.$8^2$
3. Work complete, some sequential steps wrong, thus vitiating the answer. $+5$ for 1st, P.R.$^4$, P.R.8
4. Failure to recognize additional answers after 1st. $-2^5, -3^3, -5$
5. General method correct, but vitiated by omitted parts (suggestive of memory work). $-4^2, -5^5$, P.R.
6. Uncompleted work, homogeneous, all steps of equal value (*e. g.*, reduction, simplification). P.R.$^2$, ?$^6$
7. Uncompleted work, not homogeneous, the last step the important one. $-5^7, -6$
8. Uncompleted work, similar co-ordinate steps (*e. g.*, expansion of terms). $-2+^2$, P.R.$^4$, P.R.$8^2$
9. Uncompleted work, sequential steps (*e. g.*, addition

### B. *Algebra.*

1. Answer correct, but left in unreduced form (*e. g.*, $\sqrt{1}$, $\sqrt{4}$, $3/\frac{3}{5}$). $-1^{8}$
2. First of several answers. $+7^{6}$, P.R.$^{2}$
3. Definition inadequate because of too general language (*e. g.*, a variable = a quantity which varies). $-4$, $-5^{7}$, $-10$
4. Definition inadequate, because of some latent essential lacking (*e. g.*, exponent = a figure above and to the right). $-7$, $-8$, $-10^{6}$, $-10$
5. Formula given in place of theorem called for (*e. g.*, binomial formula for the binomial theorem). $-2^{2}$, $-3$, $-4^{2}$, $-5^{2}$, $-8$
6. Initial statement of formulæ in a problem. $+2^{7}$, $+4$
7. Initial application of formula (*e. g.*, expansion by binomial theorem). $+3^{2}$, $+4^{3}$, $+5^{3}$
8. Initial application of formula; following steps (*e. g.*, simplification of terms in binomial theorem expansion). P.R.3, P.R.5, P.R.7$^{2}$
9. Intentional omission in transcribing (*e. g.*, dropping denominators). $-5^{8}$
10. Omission of ± in quadratics. $-2^{2}$, $-2+^{2}$, $-3^{3}$, $-4$
11. Failure to recognize the *existence* of more than one answer. $-2^{2}$, $-2+^{2}$, $-3^{3}$, $-4$
12. Initial statement of equations in algebraic problem. $+5$

### C. *Geometry.*

1. Correct step in demonstration, but omission of authority. $-1^{2}$, $-2^{3}$
2. Authority suggested, but not formally stated (in a demonstration). $-0^{7}$, $-1$
3. Omission of hypothesis in part or in whole, but correct use of same. $-1^{7}$, $-2$
4. Redundancy in steps of proof. $-0^{5}$, $-1^{4}$, $-2$
5. Auxiliary line omitted in text, though made in diagram and there used. $-1^{5}$, $-2$, $-3^{2}$
6. Omission to draw final conclusion formally. $-1^{7}$, $-2$
7. Definition inadequate, because of too general language (*e. g.*, spherical angle = intersection of two arcs). $-4$, $-5^{7}$, $-10$

8. Definition inadequate because of some latent essential lacking (*e. g.*, slant height = distance between two base edges of the frustrum). $-7$, $-8$, $-10^6$, $-10$
9. Answer in computation examples correct, but no intervening work or diagram, or hint as to method. $-5^6$
10. Imposing too many conditions on construction line (auxiliary), though the unwarranted conditions not used and thus the proof not vitiated. $-2^3$, $-3^4$
11. Asserting previous consequence which has not been drawn though perhaps hinted at. $-1^2$, $-2$, $-3^3$, $-3+$
12. Deduction of consequences by too long a step, with correct authorities so far as given, but with lacunæ in the chain of argument. $-1$, $-2^2$, $-3^4$, $-5$
13. Introduction of irrelevant matter. $-0$, $-1^4$, $-1+^2$, $-2$
14. Introduction of unnecessary steps. $-0^2$, $-1^3$, $-1+^3$
15. Q.E.D. used before the final equation is interpreted into language as required by the theorem. $-0$, $-1^7$
16. Construction problem: diagram apparently correct, with construction more or less indicated, but with no explanation. $-4^5$
17. Construction problem: diagram correct, but required proof not given. $-4^2$, $-5^4$, $-4+$, $-10$
18. Computation problem, initial equations correct, subsequent algebra wrong. $+5$

### IV. MISTAKES IN CALCULATION.

Important errors $-5$

Minor errors. $-2$

1. Balancing errors, right result (*e. g.*, mistakes in characteristics of logarithms). $-5^6$, $-6^2$
2. Computation problem in geometry, initial equations correct, subsequent algebra or arithmetic wrong. $+5$